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Introduction

Throughout history, humans have looked to nature as a source of new medicine and tools. In modern times, that search has become a highly profitable commercial enterprise.[1] Biodiversity prospecting (bioprospecting)—the search for naturally occurring and commercially valuable genetic and biochemical resources[2]—has led to many significant pharmaceutical and industrial advancements, including the development of drugs to treat cancer and HIV as well as the discovery of bioremediation tools to aid in oil spill cleanups.[3] Though many bioprospecting missions focus on plants and tropical rainforests, the marine environment and its unique inhabitants represent a promising new area of research.[4]

Scientists previously considered the deep seas to be azoic, or devoid of living organisms;[5] however, research has revealed that the deep-sea ecosystem contains an extremely diverse array of organisms.[6] Despite the deep sea's freezing temperatures, high water pressure, and low light levels, as well as the high temperature and acidity levels associated with deep-sea hydrothermal vents, many deep-sea organisms flourish in the extreme conditions of the seabed.[7] With recent developments in biotechnology, scientists have gained significant insight into how these organisms survive in their extreme environments by isolating and studying the specific DNA sequences responsible for these organisms' adaptations.[8] The pharmaceu-

1. *See* Richard J. McLaughlin, *Foreign Access to Shared Marine Genetic Materials: Management Options for a Quasi-Fugacious Resource*, 34 OCEAN DEV. & INT'L L. 297, 298 (2003) (noting that seven of the world's twenty-five top-selling drugs came from naturally occurring genetic resources, totaling $11.6 billion in sales).

2. *See* SALVATORE ARICO & CHARLOTTE SALPIN, UNITED NATIONS UNIV.-INST. ADVANCED STUDIES, BIOPROSPECTING OF GENETIC RESOURCES IN THE DEEP SEABED: SCIENTIFIC, LEGAL AND POLICY ASPECTS 8 (2005).

3. *See, e.g.*, DAVID LEARY, UNITED NATIONS UNIV.-INST. ADVANCED STUDIES, BIOPROSPECTING IN THE ARCTIC 12-17 (2008) [hereinafter LEARY, UNU-IAS REPORT].

4. *See, e.g.*, DAVID KENNETH LEARY, INTERNATIONAL LAW AND THE GENETIC RESOURCES OF THE DEEP SEA 13 (2007) [hereinafter LEARY, DEEP SEA]; Lyle Glowka, *Bioprospecting, Alien Invasive Species, and Hydrothermal Vents: Three Emerging Legal Issues in the Conservation and Sustainable Use of Biodiversity*, 13 TUL. ENVTL. L.J. 329, 349-60 (2000).

5. *See* WILLIAM J. BROAD, THE UNIVERSE BELOW: DISCOVERING THE SECRETS OF THE DEEP SEA 45 (1997).

6. According to a recent estimate, deep-seas species represent as much as 78.5%-96% of global biodiversity. *Id* at 46.

7. *See* LEARY, UNU-IAS REPORT, *supra* note 3, at 9; LEARY, DEEP SEA, *supra* note 4, at 7-9. Hydrothermal vents are underwater hot springs associated with tectonically active portions of the deep seabed whose fluid is a mixture of seawater, dissolved minerals and chemicals such as hydrogen sulfide. Glowka, *supra* note 4, at 349 n.98 (citing ELLIOTT A. NORSE ET AL., GLOBAL MARINE BIOLOGICAL DIVERSITY: A STRATEGY FOR BUILDING CONSERVATION INTO DECISION MAKING 6, 7, 11 (1993)); *see also* ARICO & SALPIN, *supra* note 2, at 9-13.

8. *See* LEARY, UNU-IAS REPORT, *supra* note 3, at 12-17.

tical industry is eager to utilize this emerging information in the search for novel drugs,[9] while the textile, cosmetics, and other chemical manufacturing industries are hoping to incorporate the discoveries into their own operations.[10]

Bioprospecting for these marine genetic resources (MGRs) implicates two major international legal disciplines. The first is environmental law with a focus on the sustainable development and conservation of living resources, as well as the environmental impact of bioprospecting research missions.[11] This approach frames the issue as one of maintaining biodiversity.[12] The second approach is property law, which deals with both the right of access to the deep-sea organisms themselves and the right to reap the benefits of the resulting genetic information.[13] Unlike the environmental approach, property law treats deep-sea organisms as genetic resources and revolves around ownership issues.[14] This Note will examine the latter category of ownership.

Access to and ownership of deep-sea MGRs are two emerging and highly contentious issues, particularly with regard to Arctic and Antarctic MGRs.[15] Although some MGR-rich areas are located within national jurisdictions and their respective Exclusive Economic Zones (EEZs),[16] the majority of MGRs, including those in the polar regions, are located in waters that are beyond all national jurisdictions.[17] Unfortunately, the

9. *See* ARICO & SALPIN, *supra* note 2, at 27.

10. *See* LEARY, UNU-IAS REPORT, *supra* note 3, at 12-17.

11. *See, e.g.*, David J. Bederman & Soniya P. Keskar, *Antarctic Environmental Liability: The Stockholm Annex and Beyond*, 19 EMORY INT'L L. REV. 1383 (2005); George Frisvold & Kelly Day-Rubenstein, *Bioprospecting and Biodiversity Conservation: What Happens When Discoveries Are Made?*, 50 ARIZ. L. REV. 545 (2008).

12. *See* ANTHONY J. STENSON & TIM S. GRAY, THE POLITICS OF GENETIC RESOURCE CONTROL 4 (1999); *see, e.g.*, Anna Vinson, Note, *Deep Sea Bottom Trawling and the Eastern Tropical Pacific Seascape: A Test Case for Global Action*, 18 GEO. INT'L ENVTL. L. REV. 355, 356-59 (2006) (discussing environmental effects of deep-sea bottom trawling on maintaining biodiversity).

13. *See, e.g.*, Kirsten E. Zewers, *Bright Future for Marine Genetic Resources, Bleak Future for Settlement of Ownership Rights: Reflections on the United Nations Law of the Sea Consultative Process on Marine Genetic Resources*, 5 LOY. U. CHI. INT'L L. REV. 151, 151-52 (2008) (proposing a property law solution that resolves access issues and provides benefits to countries involved in oceanographic excavation).

14. *See* STENSON & GRAY, *supra* note 12, at 4 (terming deep-sea organisms as "genetic resources"); Zewers, *supra* note 13, at 151-52 (framing the property issue as one of ownership).

15. *See* LEARY, UNU-IAS REPORT, *supra* note 3, at 7-8; David Leary, *Bi-Polar Disorder? Is Bioprospecting an Emerging Issue for the Arctic as Well as for Antarctica?* 17 RECIEL 41, 45 (2008) [hereinafter Leary, *Bi-Polar Disorder?*]; *see also infra* Part III for a discussion of the current state of debates among UN member states on this issue.

16. *See* LEARY, UNU-IAS REPORT, *supra* note 3, at 5; *see also infra* note 125 and accompanying text.

17. *See* Leary, *Bi-Polar Disorder?*, *supra* note 15, at 54-55 (noting that, although most Arctic bioprospecting occurs within areas of national jurisdiction, bioprospecting activities in the limited areas beyond national jurisdiction nonetheless represent an important emerging issue); Rosemary Rayfuse, *Protecting Marine Biodiversity in Polar Areas Beyond National Jurisdiction*, 17 RECIEL 3, 10 (2008) (observing that only a small portion of the Arctic seabed is beyond all jurisdiction); *see also* LEARY, UNU-IAS REPORT, *supra* note 3, at 7. For further discussion of territorial limits and EEZs under the United

existing international regulatory framework—which includes the United Nations Convention on the Law of the Sea[18] and the Convention on Biological Diversity[19]—was instituted prior to the development of the MGR biotechnology industry and, thus, does not provide nations with adequate guidance concerning the issues of deep-sea MGR access or benefit sharing.[20] Though the Convention on Biological Diversity (CBD) provides participating nations with ownership rights over the resources within their national boundaries,[21] the CBD does not provide a binding solution for extraterritorial resources.[22] Additionally, the United Nations Convention on the Law of the Sea (UNCLOS)—the most directly relevant treaty—does not contain any provisions for living organisms in the deep-seabed or the high seas—only for mineral resources.[23] Furthermore, neither the Antarctic Treaty System nor the Helsinki Treaty[24]—the relevant framework for resources in the Antarctic and Arctic regions, respectively[25]—provide any answers to the questions that polar MGRs pose.[26]

At present, there is no consensus among nations with an economic stake in the outcome of MGR access and benefit-sharing regulation as to how to fill the gaps in the current regulatory framework.[27] Part of the difficulty in achieving a consensus stems from a conflict among developed and developing nations regarding the status of the genetic information derived from MGRs.[28] Due to the large technological expenses associated with bioprospecting in these extreme environments, developed nations currently have a stronghold on MGR research.[29] Consequently, nations such as the United States, Canada, and Japan support the traditional property rule of capture, which provides that the first nation to discover and appropriate the genetic resources retains ownership of the resulting informa-

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Nations Convention on the Law of the Sea, see *infra* notes 124-131 and accompanying text.

18. United Nations Convention on the Law of the Sea, Dec. 10, 1982, 1833 U.N.T.S. 397 [hereinafter UNCLOS].

19. *See* Convention on Biological Diversity, June 5, 1992, 1760 U.N.T.S. 79 [hereinafter CBD]; Zewers, *supra* note 13, 153-54.

20. Zewers, *supra* note 13, at 168-70.

21. *See* CBD, *supra* note 19, art. 15.

22. *See* Donald K. Anton, *Law for the Sea's Biological Diversity*, 36 COLUM. J. TRANSNAT'L L. 341, 355-56 (1997).

23. *See* David R. Downes et al., *International Environmental Law*, 42 INT'L LAW. 285, 288 (2008); *see also* UNCLOS, *supra* note 18.

24. Treaty of Cooperation Between Denmark, Finland, Iceland, Norway, and Sweden, Mar. 23, 1962 [hereinafter Helsinki Treaty].

25. *See* Leary, *Bi-Polar Disorder?*, *supra* note 15, at 42, 49.

26. *See, e.g.*, *id.* at 41, 47-48.

27. *See* Juan Manuel Gómez-Robledo & Robert Hill, Letter from the Co-Chairpersons of the Ad Hoc Open-Ended Informal Working Group to Study Issues Relating to the Conservation and Sustainable Use of Marine Biological Diversity Beyond Areas of National Jurisdiction to the President of the General Assembly, Annex, ¶ 36, U.N. DOC. A/63/79 (May 16, 2008).

28. *See* Zewers, *supra* note 13, at 170-73.

29. *See* Melissa Weber, *Accreditation as a Regulatory Option for Antarctic Bioprospecting*, 42 POLAR REC. 349, 350 (2006); Zewers, *supra* note 13, at 151.

tion.[30] In contrast, developing nations argue that MGRs are part of the common heritage of mankind and that resulting genetic information, and any benefits that result from that information, should be available to the entire world.[31]

This Note will examine the developing interaction between extraterritorial MGR regulation and the Arctic and Antarctic regions by first identifying the shortcomings of the current regulatory framework for polar MGR access and benefit sharing and, second, by analyzing the potential impact that proposed MGR regulatory measures could have on the polar regions. Part I of this Note will examine why polar MGR research and use are important emerging fields and how they interact with intellectual property laws domestically and internationally. Part II will identify specific gaps in the existing regulatory framework with respect to extraterritorial MGR access and benefit sharing in the polar regions. Part III will examine the highly political nature of genetic resource control arguments and summarize the current state of debates among developed and developing nations. Finally, Part IV will assess the viability of a number of gap-filling measures that United Nations delegates proposed at the 2008 meeting of the Ad Hoc Open-Ended Informal Working Group tasked with determining the legal status of MGRs and how each of these options could impact regulation in the polar regions. In particular, Part IV will examine the possibility of amending the existing framework, implementing short-term actions, establishing or modifying regional MGR rights management projects, creating a new international regulatory instrument, or maintaining the status quo of the rule of capture.

I. The Significance of Polar Region MGRs

A. Polar Regions and the Deep Sea Habitat

Although rainforests are biodiversity hotspots, the world's oceans make the rainforests seem barren by comparison.[32] The oceans contain an overwhelming majority of the world's total biomass, with microorganisms representing more than 95% of that amount.[33] The deep seabed is home to an enormous number of species, particularly around hydrothermal vents.[34] Scientists have discovered more than 500 species of organisms at vent sites, 80%-90% of which were previously unknown.[35] Vent sites also contain the highest level of microbial diversity on earth.[36] Despite the

30. *See* McLaughlin, *supra* note 1, at 319-22 (explaining the rule of capture); Zewers, *supra* note 13, at 172-73 (discussing the position of developed nations).

31. *See* Zewers, *supra* note 13, at 170-72.

32. *See* LEARY, DEEP SEA, *supra* note 4, at 14.

33. *See* BROAD, *supra* note 5, at 46; LEARY, UNU-IAS REPORT, *supra* note 3, at 9.

34. *See* LEARY, DEEP SEA, *supra* note 4, at 15-16.

35. *See id.*

36. *See id.*

enormous potential for scientific discoveries in the oceans,[37] scientists have investigated less than 0.001% of the deep seabed.[38]

The vast array of biodiversity in the deep seas is surprising because, at first glance, the environment appears harsh and inhospitable.[39] Ninety percent of the ocean's waters are five degrees Celsius or colder, including the polar seas and the deep seabed.[40] In contrast to the extreme cold, the temperature surrounding hydrothermal vents can exceed 350 degrees Celsius.[41] Additionally, the water surrounding hydrothermal vents can contain high levels of naturally occurring, but toxic, heavy metals that create extremely acidic pH levels.[42] Despite these adverse environmental conditions, the microorganisms that thrive in the extreme environments of the polar region deep seas have many special adaptations.[43] As part of the ongoing International Polar Year,[44] scientists are currently conducting a comprehensive census of marine life in the polar regions to document the multitude of species that have developed such adaptations to the similar environments of the Arctic and Antarctic regions.[45] The genetic bases for these adaptations are what scientists studying MGRs hope to uncover.

B. Polar MGR Research and Commercial Applications

Many countries have devoted substantial funding to MGR bioprospecting missions in the polar regions, both within sovereign waters and in areas beyond all national jurisdictions. For example, the Norwegian government established a National Plan for Functional Genomics (the FUGE Programme) in 2002 to conduct bioprospecting missions in the Arctic and to

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37. Some scientists believe that studying the unique biochemistry of hydrothermal vent ecosystems will help them understand the origins of life on Earth and will aid in the search for life on Mars and other planets. *See id.* at 18-23.

38. *See id.* at 14.

39. *See id.* at 7-8 (describing the traditional perception of the deep sea as evil and foreboding).

40. *See* LEARY, UNU-IAS REPORT, *supra* note 3, at 9 (citing R.Y. Morita, *Psychrophilic Bacteria*, 39 BACTERIOLOGICAL REVS. 144 (1975)).

41. *See* LEARY, DEEP SEA, *supra* note 4, at 11.

42. *See id.* at 159.

43. *See* LEARY, UNU-IAS REPORT, *supra* note 3, at 9.

44. The International Polar Year is an internationally coordinated series of intense research missions in the Arctic and Antarctic regions. *See* U.S. Geological Survey, International Polar Year 2008—Description and History, http://international.usgs.gov/ipy/history.shtml (last visited Oct. 8, 2009). The goal of the event is for participating nations to combine their resources and knowledge to conduct large-scale cooperative research projects that individual nations would be unable to achieve alone. *See id.* Though originally intended to last from 2007-2008, the latest Year was extended until March 2009 due to the success of the first twelve months. *See id.* The 2007-2008 event marked the fourth International Polar Year, the first being in 1882-1883 and the last in 1957-1958. *See id.*

45. *See* Press Release, Census of Marine Life, Polar Bears and Penguins May Live at Opposite Poles, But Census of Marine Life Explorers Find Hundreds of Identical Species Thrive in Both Arctic and Antarctic (Feb. 15, 2009), *available at* http://www.coml.org/comlfiles/press/CoML_Ice_Oceans_Public_Release_02.15.2009.pdf.

exploit the MGRs within its territorial waters and EEZ.[46] Within the first year of the program's operation, the government invested approximately €17.5 million in the search for enzymes, enzyme inhibitors, antioxidants, and immune modulators.[47]

The primary actors carrying out bioprospecting missions are nationally funded scientific research organizations and academic institutions.[48] A major goal of these bioprospecting missions is to locate MGRs with adaptations that will have therapeutic or commercial value, such as the ability to produce enzymes that can function at very high or very low temperatures (known as extremophiles).[49] This Part will discuss a few examples of the numerous commercial applications of polar MGRs.

1. Health Care

An example of the high commercial profitability of "extremophilic" enzymes in the health care industry is the DNA polymerase enzyme *Thermus aquaticus*.[50] This enzyme is capable of withstanding the extremely high temperatures of the heating cycles used in the polymerase chain reaction—a biochemical process that plays an important role in medical diagnoses and forensics by facilitating DNA replication.[51] The exclusive world rights to the enzyme belong to a single Swiss pharmaceutical company, and annual sales of the enzyme itself are as high as $100 million.[52] In the United States alone, this one enzyme is the foundation of a $300 million industry.[53]

MGRs also have been the source of many medicines, including "hormonal modulators, antioxidant, antiviral[ ], anti-inflammatory, anti-fungal,

46. *See* Leary, *Bi-Polar Disorder?*, *supra* note 15, at 47-48; *see also infra* notes 129-137 and accompanying text for a discussion of territorial boundary limits under the United Nations Convention on the Law of the Sea.

47. *See* Leary, *Bi-Polar Disorder?*, *supra* note 15, at 47-48.

48. ARICO & SALPIN, *supra* note 2, at 16-19 (describing various deep-seabed research programs throughout the world); Leary, *Bi-Polar Disorder?*, *supra* note 15, at 47-48. *But see* U.N. Informal Consultative Process on Oceans & the Law of the Sea, June 25-29, 2007, *An Update on Marine Genetic Resources: Scientific Research, Commercial Uses and a Database on Marine Bioprospecting*, § 1.2 [hereinafter *Marine Genetic Resources*], *available at* http://www.ias.unu.edu/resource_centre/Marine%20Genetic%20Resources%20UNU-IAS%20Report.pdf (noting that some private companies have provided funding for scientific organizations' missions).

49. For a useful summary of the stages of the bioprospecting process from collection to sales and marketing of the resulting products, see LEARY, DEEP SEA, *supra* note 4, at 164-69.

50. *See* DAGMAR LOHAN & SAM JOHNSTON, UNITED NATIONS UNIV-INST. ADVANCED STUDIES, THE INTERNATIONAL REGIME FOR BIOPROSPECTING: EXISTING POLICIES AND EMERGING ISSUES FOR ANTARCTICA 10 (2003), *available at* http://www.ias.unu.edu/binaries/UNUIAS_AntarcticaReport.pdf.

51. *See id.*; The Secretary-General, *Report of the Secretary-General on Oceans and the Law of the Sea*, ¶ 164, *delivered to the General Assembly*, U.N. Doc. A/62/66 (Mar. 12, 2007) [hereinafter *Secretary-General Report*].

52. *See* LOHAN & JOHNSTON, *supra* note 50, at 10. These figures have likely increased dramatically since their initial publication date. At the time, the forecast for market expansion was approximately 15%-20% per year. *See id.*

53. *Id.*

anti-HIV, antibiotic, anti[-]cancer, anti-tuberculosis and anti[-]malarial drugs."[54] One such drug is the chemotherapy agent, cytarabine, which comes from a marine sponge and is highly effective in treating various forms of leukemia and lymphoma.[55] Similarly, researchers have found that salinosporamide—a bioactive molecule from bacteria that live in marine sediment—is a highly effective anti-cancer agent and currently are conducting Phase I trials on humans.[56] Other examples of MGR-derived anti-cancer and antiviral drugs include bryostatin-1, halichondrin B, and dolastatin-10.[57] Researchers believe that compounds such as these will "revolutionize cancer treatment" by "disrupting tumor-specific cell signaling, cell division, energy metabolism, gene expression, [and] drug resistance."[58]

2. *Industrial Uses*

The global market for industrial enzymes is approximately $50 billion a year with recent annual increases of 3%-5%.[59] Applications of these enzymes are varied.[60] Many industries capitalize on the unique adaptations of hydrothermal vent microbes by using them to treat industrial waste products and to desulphurize oil and coal.[61] The paper goods manufacturing industry utilizes one enzyme that researchers derived from a hydrothermal vent microorganism to facilitate starch liquefaction.[62]

The food industry also incorporates enzymes from Arctic marine bacteria into its production processes.[63] For example, the dairy industry utilizes cold-active beta-galactosidase to reduce the lactose content of milk and cold-active lipases to accelerate fermentation in cheese, beer, and dough products.[64] Additionally, one species of Antarctic fish contains a unique glycoprotein—a substance that has similar properties to antifreeze[65]—that helps prolong the shelf life of some frozen food products.[66]

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54. *Secretary-General Report*, *supra* note 51, ¶ 164.

55. *See Marine Genetic Resources*, *supra* note 48, § 2.1; *see also* Jamal M. Arif et al., *Novel Marine Compounds: Anticancer or Genotoxic?*, 2 J. BIOMEDICINE & BIOTECHNOLOGY 93, 93 (2004).

56. *See Secretary-General Report*, *supra* note 51, ¶ 164 (citing Robert H. Feling et al., *Salinosporamide A: A Highly Cytotoxic Proteasome Inhibitor from a Novel Microbial Source, A Marine Bacterium of the New Genus Salinospora*, 42 ANGEWANDTE CHEMIE INT'L EDITION 355, 355-57 (2003)).

57. *See id.*; *see also Marine Genetic Resources*, *supra* note 48, § 2.1. For a comprehensive list of MGR-derived anti-cancer agents, see Thomas E. Adrian, *Novel Marine-Derived Anti-Cancer Agents*, 13 CURRENT PHARMACEUTICAL DESIGN 3417 (2007).

58. *See Marine Genetic Resources*, *supra* note 48, § 2.1.

59. *See id.* § 4.3.

60. *See* Patrick Lorenz & Jürgen Eck, *Metagenomics and Industrial Applications*, 3 NATURE REVS.: MICROBIOLOGY 510, 510 (2005) ("Enzymes are used in a wide range of applications and industries.").

61. *See Marine Genetic Resources*, *supra* note 48, § 4.5

62. *See id.* § 4.3, box 2 (noting that the annual market for this enzyme is approximately $150 million).

63. *See* LEARY, UNU-IAS REPORT, *supra* note 3, at 12.

64. *See id.*

65. *See* Leary, *Bi-Polar Disorder?*, *supra* note 15, at 41.

66. *See id.*

3. Bioremediation

Arctic and Antarctic MGRs also show promise for bioremediation tasks such as cleaning up oil spills, contaminated soil, and other environmental pollutants.[67] Researchers have found that some marine microorganisms that can degrade petroleum and other chemicals that naturally seep out of cracks in the deep seabed also are well suited for bioremediation in the polar regions.[68] For example, marine cyanobacteria are able to filter out chemical waste and heavy metals, such as cadmium and cobalt, from industrial effluents before the pollutants reach the environment.[69] Researchers also believe that cold-adapted MGRs will provide a more cost-efficient remedy for the widespread hydrocarbon fuel pollution surrounding Arctic mining sites and scientific and military bases.[70]

4. Cosmeceuticals

Many MGR byproducts have contributed to a new and highly profitable subset of the cosmetics industry that focuses on products known as cosmeceuticals.[71] A cosmeceutical product is a "cosmetic product that claims to or has been found to have biologic activity."[72] Examples of cosmeceutical products using MGR byproducts include anti-aging creams that contain pseudopterosin—an anti-inflammatory chemical that sea fans produce.[73] Additionally, some skin, hair, and nail treatment products contain a glycoprotein from the Antarctic bacteria, *Pseudoalteromonas antarctica*, which promotes healing.[74] AGI Dermatics and Phytomer—a French company that specializes in marine cosmetics—are among the many companies that market cosmeceutical products containing MGR byproducts.[75]

C. A Brief Look at Patentability Standards in the United States and Abroad

The primary form of ownership for MGR-derived products comes from patents.[76] Based on a survey of their respective patent application

67. *See* LEARY, UNU-IAS REPORT, *supra* note 3, at 13-14.
68. *See id.*; Glowka, *supra* note 4, 349 n.98.
69. *See Secretary-General Report*, *supra* note 51, ¶ 168.
70. *See* LEARY, UNU-IAS REPORT, *supra* note 3, at 13-14.
71. The estimated global market for the cosmeceutical industry is $6 billion. Daniel Putterman, *Incorporating Genetic Resource Utilization into ICZM—Policies and Institutions in Jamaica*, *in* INTEGRATED COASTAL ZONE MANAGEMENT OF CORAL REEFS: DECISION SUPPORT MODELING 175, 178 (Kent Gustavson et al. eds., 2000).
72. Deborah E. Mason, Note, *Kiss and Make-up: A Need For Consolidation of FDA and Cosmetic Industry Regulation Programs*, 18 HEALTH MATRIX 181, 183 (2008) (quoting Melissa C. Lazarus & Leslie S. Baumann, *The Use of Cosmeceutical Moisturizers*, 14 DERMATOLOGIC THERAPY 200, 200 (2001)).
73. *Id.*
74. *See* LOHAN & JOHNSTON, *supra* note 50, at 7; Antarticine-NF3 for the Treatment and Re-Epithelialisation of Wounds, Patent ES2181592 (published Feb. 16, 2003), *available at* http://v3.espacenet.com/publicationDetails/biblio?DB=EPODOC&adjacent=True&locale=EN_EP&FT=D&date=20030216&CC=ES&NR=2181592A1&KC=A1.
75. *See Marine Genetic Resources*, *supra* note 48, § 4.4.
76. *See* Zewers, *supra* note 13, at 158.

databases, the United States and the European Union (EU) have approved at least thirty-seven patents for deep-sea MGR products,[77] thirty-one of which were from the Arctic region.[78] With regard to Antarctic-derived products, Japanese companies represent the largest portion of patent applications,[79] followed by German companies.[80] This section provides a brief examination of the patentability standards that inventors must satisfy to acquire patent protection for their discoveries in both the United States and abroad.

In the United States, intellectual property laws grant exclusive patent rights for twenty years from the date of filing to anyone who "invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof."[81] The Supreme Court clarified the threshold for patentability in the landmark case *Diamond v. Chakrabarty*.[82] The case arose when Chakrabarty, a scientist, attempted to patent a type of superbacteria that he created through recombinant DNA technology to process and breakdown crude oil,[83] similar to bioremediation MGRs.[84] The Court upheld the patentability of Chakrabarty's creation and ruled that "anything under the sun that is made by man" is patentable, including a live, human-made microorganism.[85] The Federal Circuit provided additional guidance in *AmGen v. Chugai Pharmaceuticals* by ruling that isolated and purified gene sequences are patentable, though genes as part of naturally occurring chromosomes are not.[86] Because MGR DNA derivative patents are isolated and purified gene sequences that are separate from the naturally occurring marine organisms, they satisfy the basic threshold for patentability and usually will be upheld, provided that the "invention" meets the additional

77. *Marine Genetic Resources*, *supra* note 48, § 3.2. For a breakdown of the percentages attributable to constituent nations, see LEARY, UNU-IAS REPORT, *supra* note 3, at 22.

78. *See* LEARY, UNU-IAS REPORT, *supra* note 3, at 22.

79. ARICO & SALPIN, *supra* note 2, at 29.

80. *Id.* Examples of companies that have applied for patents derived from Antarctic marine genetic resources include Bayer AG (Germany), Henkel KGAA (Germany), SmithKline Beecham, Astra, Novonordisk (Denmark), Du Pont (United States), Chisso Corporation (Japan), Loders Croklaan (The Netherlands), Haarmann & Reimer GmbH (Germany), Unilever (United Kingdom), Lysi HF (Iceland), DSM NV (The Netherlands), Jujo Paper Co. Ltd. (Japan), Mitsubishi Gas Chemical Company Inc. (Japan), Higashimaru Shoyu Company Ltd. (Japan), Tokuyama Corporation (Japan), Lion Corporation (Japan), and Nippon Soda Company Ltd. (Japan). *Id.*

81. *See* 35 U.S.C. §§ 101, 154(a)(1)-(2) (2008).

82. *See* Diamond v. Chakrabarty, 447 U.S. 303 (1980).

83. *See id.* at 305.

84. *See supra* notes 67-70 and accompanying text.

85. *Diamond*, 447 U.S. at 309 (distinguishing human-made products and processes from the laws of nature, physical phenomena, and abstract ideas).

86. *See* Amgen, Inc. v. Chugai Pharm. Co., Ltd., 927 F.2d 1200 (Fed. Cir. 1991), *cert. denied sub nom.* Genetics Inst. v. Amgen, Inc., 502 U.S. 856 (1991) (approving the patentability of the purified isolated DNA sequence that codes for the naturally-occurring human protein, erythropoietin, which boosts red blood cell counts and has a significant commercial market for pharmaceutical companies).

requirements of utility and novelty.[87]

Although international patent protection varies according to each nation's standards, international organizations have made some efforts to align those standards.[88] The Agreement on Trade Related Aspects of Intellectual Property Rights (TRIPS) is an international agreement intended to coordinate the World Trade Organization member states' intellectual property laws.[89] Under TRIPS, member states are able to set their own patentability standards, with only minimal requirements.[90] Some permissible exclusions to patentability exist in order to protect the larger goals of public order and morality, such as protecting human, animal, or plant health and environmental integrity.[91] For example, TRIPS allows member states to refuse patents for plants and animals as well as the biological production processes for those organisms.[92] Microorganisms, however, are excluded from that provision; member states cannot refuse equitable patent protection for microorganisms and non-biological and microbiological processes.[93] Once a patent is issued, under TRIPS, the patent owner will have exclusive rights to that "invention" and can prevent third parties in other nations from using that process or product.[94]

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87. *See* Zewers, *supra* note 13, at 161; *see also* In re Fisher, 421 F.3d 1365, 1379 (Fed. Cir. 2005) (reinforcing the substantial and specific utility requirements for patentability by rejecting a patent for a purified DNA strand of maize that lacked specific utility).

88. *See* Zewers, *supra* note 13, at 159.

89. *See* Agreement on Trade-Related Aspects of Intellectual Property Rights, Apr. 15, 1994, Marrakesh Agreement Establishing the World Trade Organization, Annex 1C, 1869 U.N.T.S. 299 [hereinafter TRIPS]; Zewers, *supra* note 13, at 159. TRIPS was enacted in 1994 as a result of the Uruguay Round of negotiations that also established the WTO. *See* CHRISTOPHER MAY, A GLOBAL POLITICAL ECONOMY OF INTELLECTUAL PROPERTY RIGHTS: THE NEW ENCLOSURES? 68 (2000).

90. *See* TRIPS, *supra* note 89, art. 27(1) (stating that "patents shall be available for any inventions, whether products or processes, in all fields of technology, provided that they are new, involve an inventive step and are capable of industrial application"); Carlos M. Correa, *Internationalization of the Patent System and New Technologies*, 20 WIS. INT'L L.J. 523, 548 (2002).

91. *See* TRIPS, *supra* note 89, art. 27; G. GREGORY LETTERMAN, BASICS OF INTERNATIONAL INTELLECTUAL PROPERTY LAW 178 (2001); MAY, *supra* note 89, at 74.

92. *See* TRIPS, *supra* note 89, art. 27; LETTERMAN, *supra* note 91, at 178. Examples of countries that have refused to extend patent protection to plants and animals include Brazil, India, and Norway. *See* Sabrina Safrin, *Hyperownership in a Time of Biotechnological Promise: The International Conflict to Control the Building Blocks of Life*, 98 AM. J. INT'L L. 641, 645 n.24 (2004).

93. *See* TRIPS, *supra* note 89, art. 27; LETTERMAN, *supra* note 91, at 178; Correa, *supra* note 90, at 548. In fact, most developed countries have issued patents for microorganisms, genetically modified plants and animals, and isolated and purified genes and genetic sequences. *See* Sean D. Murphy, *Biotechnology and International Law*, 42 HARV. INT'L L.J. 47, 62-65 (2001).

94. *See* TRIPS, *supra* note 89, art. 28(1) ("A patent shall confer on its owner the following exclusive rights: (a) where the subject matter of a patent is a product, to prevent third parties not having the owner's consent from the acts of: making, using, offering for sale, selling, or importing for these purposes that product; (b) where the subject matter of a patent is a process, to prevent third parties not having the owner's consent from the act of using the process, and from the acts of: using, offering for sale, selling, or importing for these purposes at least the product obtained directly by that process."); *see also infra* notes 159-170 and accompanying text for a discussion of how this potentially

II. The Current Regulatory Framework

There are a number of treaties that are relevant to the regulation of polar MGR access and benefit sharing.[95] As discussed earlier, in addition to TRIPS, four major regulatory documents touch upon the issues of access and ownership but do not provide any guidance for how to deal with emerging ownership issues in the Arctic and Antarctic regions.[96] This Part will examine the coverage of the Antarctic Treaty System, the Helsinki Treaty, the Convention on Biological Diversity, and the United Nations Convention on the Law of the Sea, and will discuss the treaties' shortcomings in addressing extraterritorial polar MGRs.

A. The Antarctic Treaty System

The first relevant regulatory document is the Antarctic Treaty, which is part of the Antarctic Treaty System (ATS)—a series of treaties regulating access to and activities in the Antarctic region, including all ice shelves and land below 60 degrees south latitude.[97] Signatories of the Antarctic Treaty include Argentina, Australia, Belgium, Chile, France, Japan, New Zealand, Norway, South Africa, the Russian Federation, the United Kingdom, and the United States.[98]

The Antarctic Treaty limits extension of territorial sovereignty in Antarctica and encourages member states to cooperate with each other by exchanging information about relevant scientific observations and results.[99] However, the Treaty was signed in 1959 and went into effect in 1961,[100] well before the existence of technology to conduct large-scale genetic research or the formation of the international biotechnology industry.[101] Thus, the Antarctic Treaty does not provide further guidance on the

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can hinder scientific progress, a phenomenon known as the "Tragedy of the Anticommons."

95. *See, e.g.*, CBD, *supra* note 19; UNCLOS, *supra* note 18; Helsinki Treaty, *supra* note 24; Antarctic Treaty art. VI, Dec. 1, 1959, 12 U.S.T. 794, 402 U.N.T.S. 71.

96. *See* CBD, *supra* note 19; UNCLOS, *supra* note 18; Helsinki Treaty, *supra* note 24; Antarctic Treaty, *supra* note 95.

97. Antarctic Treaty, *supra* note 95, art. VI. Additional treaties within the Antarctic Treaty System primarily address environmental concerns. *See* Protocol on Environmental Protection to the Antarctic Treaty, Oct. 4, 1991, 30 I.L.M. 1455 (entered into force Jan. 14, 1998); Convention for the Conservation of Antarctic Marine Living Resources, May 20, 1980, 33 U.S.T. 3476, 1329 U.N.T.S. 47; Convention for the Conservation of Antarctic Seals, *opened for signature* Feb. 11, 1972, 29 U.S.T. 441, 11 I.L.M. 251 (entered into force Mar. 11, 1978); Agreed Measures for the Conservation of Antarctic Fauna and Flora, June 13, 1964, 17 U.S.T. 992 (entered into force Nov. 1, 1982), *reprinted in* 1 W.M. BUSH, ANTARCTICA AND INTERNATIONAL LAW: A COLLECTION OF INTER-STATE AND NATIONAL DOCUMENTS 146-69 (1982).

98. For a current list of member states, see Parties to the Antarctic Treaty System, http://www.ats.aq/devAS/ats_parties.aspx?lang=E (last visited Oct. 8, 2009) [hereinafter List of Parties].

99. Antarctic Treaty, *supra* note 95, art. III.

100. Secretariat of the Antarctic Treaty, The Antarctic Treaty, http://www.ats.aq/e/ats_treaty.htm (last visited Oct. 8, 2009).

101. *See* Bernard P. Herber, *Bioprospecting in Antarctica: The Search for a Policy Regime*, 42 POLAR REC. 139, 143 (2006).

issue of bioprospecting or MGRs.[102] Some scholars are concerned that the emerging biotechnology industry and the search for MGRs will challenge the implicit assumption of the Treaty that Antarctica is an internationally shareable resource.[103] Despite these concerns and the growing importance of MGR access and benefit sharing, there does not appear to be any impetus to reform the ATS to address that issue.[104]

B. The Helsinki Treaty

The Arctic polar region has a very different legal and regulatory regime than Antarctica.[105] Although there are a number of treaties that affect the Arctic nations, the most relevant to the issues of MGR access and benefit sharing is the Treaty of Cooperation—also known as the Helsinki Treaty—between Denmark, Finland, Iceland, Norway, and Sweden, which the nations passed in 1962 and substantially amended in 1971.[106] The Treaty encourages legal, social, economic, cultural, and environmental cooperation between the Nordic nations and established the Nordic Council and Nordic Council of Ministers.[107] The broad category of genetic resources falls under the joint jurisdiction of the Nordic Council of Ministers for Fisheries, Agriculture, Forestry, and Food and the Nordic Council of Ministers for Environmental Issues.[108] Both of these Councils consult with the Nordic Gene Resources Council, an organization that focuses on cooperation between Nordic countries regarding access to genetic resources, knowledge transfer, and capacity building, and is responsible for organizing research and development of genetic resources in the region.[109] Unfortunately, despite the Councils' awareness of the political, environmental, and economic importance of genetic resource access and benefit sharing, their primary focus has been on territorial genetic resources, and they have not yet addressed the issue of Arctic MGRs located beyond national jurisdictions.[110]

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102. *See* LOHAN & JOHNSTON, *supra* note 50, at 11, 13.

103. *See* Leary, *Bi-Polar Disorder?*, *supra* note 15, at 42; *see also* JOHN VOGLER, THE GLOBAL COMMONS: A REGIME ANALYSIS 8 (1995) (arguing that signatories never considered the marine resources associated with Antarctica to be part of the common heritage of mankind).

104. Herber, *supra* note 101, at 144.

105. *Compare* Antarctic Treaty, *supra* note 95, *with* Helsinki Treaty, *supra* note 24.

106. *See* Helsinki Treaty, *supra* note 24.

107. *See id.* arts. 39-67. The Nordic Council was established in 1952 and serves as the forum for parliamentary cooperation among member states, whereas the Nordic Council of Ministers (which was formed in 1971) is actually compromised of many councils that serve as the fora for Nordic governmental cooperation on issues such as Business, Energy, and Regional Affairs; Fishery, Agriculture, Forestry and Food Affairs; and Environmental Affairs. *See* Leary, *Bi-Polar Disorder?*, *supra* note 15, at 49 & n.93.

108. *See* Leary, *Bi-Polar Disorder?*, *supra* note 15, at 49.

109. *Id.* at 50.

110. *Id.*

C. The United Nations Convention on Biological Diversity

The next relevant treaty is the United Nations Convention on Biological Diversity (CBD). The United Nations adopted the CBD in 1992 and it became effective in 1993.[111] The Convention aims to conserve biological diversity through sustainable use and fair and equitable sharing of benefits stemming from that use.[112] An underlying goal of the CBD is to encourage the exchange of resources—both natural and economic—between Northern and Southern member states: in exchange for access to the Southern nations' abundant natural resources, Northern nations provide economic enrichment.[113]

Unlike the Antarctic Treaty System and the United Nations Convention on the Law of the Sea, the CBD directly addresses the issue of access to genetic resources.[114] It encourages member states to facilitate other states' access to genetic resources and requires prior informed consent before accessing another state's resources.[115] Although the CBD provides a clear set of rules governing access to genetic resources, these rules only apply to genetic resources located within a nation's jurisdiction.[116] An additional shortcoming of the CBD is that it only deals with access issues, not ownership, which remains under the purview of international and national laws.[117] Furthermore, the United States has not ratified the CBD and, thus, is not bound by its rules.[118]

D. The United Nations Convention on the Law of the Sea

Although the United Nations Convention on the Law of the Sea (UNCLOS) is a comprehensive and ground-breaking treaty governing member states' access to and activities on the seas, it does not address MGR access and benefit sharing. This "constitution for the oceans"[119] provides guidelines and regulations for member states regarding, *inter alia*, the limits of the territorial sea, navigation, conservation of marine biodiversity, land-locked states' right of access to and from the sea, marine scientific research, and dispute settlements.[120] The 157 nations that have signed the treaty to date include many land-locked and developing nations from all

111. *See* LOHAN & JOHNSTON, *supra* note 50, at 17. For a list of parties to the Convention on Biological Diversity, see http://www.cbd.int/convention/parties/list/ (last visited Oct. 17, 2009).

112. CBD, *supra* note 19.

113. *See* Daniel Rettig, *In Search of Pirate's Treasure: The Control and Ownership of Genetic Resources in the Mesoamerican Barrier Reef System*, 37 U. MIAMI INTER-AM. L. REV. 261, 268 (2006).

114. CBD, *supra* note 19, art. 15.

115. *Id.*

116. *Id.*

117. *See* McLaughlin, *supra* note 1, at 307.

118. *See* List of Parties, *supra* note 98.

119. Tommy T.B. Koh, President of the Third United Nations Conference on the Law of the Sea, Remarks, A Constitution for the Oceans (Dec. 11, 1982), *available at* http://www.un.org/Depts/los/convention_agreements/texts/koh_english.pdf (adapted from statements by Koh at the final session of the Conference at Montego Bay).

120. UNCLOS, *supra* note 18.

regions of the globe.[121] One notable absence from the list of signatories is the United States;[122] although the United States has approved Part XI of UNCLOS—a special provision pertaining to deep seabed mineral resources—it has not approved the remainder of the Convention.[123]

Parts II through VII of UNCLOS divide the seas into relevant regions of demarcation. First there is the territorial sea, which extends twelve miles from a nation's coastline;[124] second is the Exclusive Economic Zone (EEZ), which extends up to "200 nautical miles from the baselines from which the breadth of the territorial sea is measured;"[125] third is the continental shelf, which excludes the deep seabed and can extend up to 350 nautical miles from territorial sea baseline;[126] and lastly there are the high seas, the region beyond the EEZ to which all States have the freedom to access and conduct scientific research.[127]

Within their own EEZs, coastal nations have discretion to determine levels of activities such as fishing and conservation measures.[128] Articles

121. Div. for Ocean Affairs & the Law of the Sea, Office of the Legal Affairs, *Status of the United Nations Convention on the Law of the Sea, of the Agreement Relating to the Implementation of Part XI of the Convention and of the Agreement for the Implementation of the Provisions of the Convention Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks* (Oct. 1, 2009), *available at* http://www.un.org/Depts/los/reference_files/status2008.pdf.

122. *Id.*

123. *See id.* Despite its historical non-participation in UNCLOS, the United States might soon ratify the full treaty. On January 12, 2009, President George W. Bush issued a National Security and Homeland Security Presidential Directive regarding the future of the United States' Arctic policy. In this document, the President urged the Senate to accede to UNCLOS to protect U.S. national security interests and reinforce the nation's sovereign rights over the natural resources within its jurisdictional boundaries. *See* Presidential Directive on Arctic Region Policy, 45 WEEKLY COMP. PRES. DOC. 47 (Jan. 9, 2009) [hereinafter Presidential Directive], *available at* http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=2009_presidential_documents&docid=pd19ja09_txt-11.pdf. Furthermore, although the future of the United States' Arctic policy under President Obama's administration remains undetermined at the time of publication, it appears likely that the administration will follow the same trend that President Bush established in his last days in office. In a speech before the joint meeting of the Arctic Council and the Antarctic Treaty Consultative Meeting commemorating the fiftieth anniversary of the Antarctic Treaty, Secretary of State Hillary Clinton emphasized the importance of continuing research in and increasing attention to both the Arctic and Antarctic regions and, most significantly, the United States' accession to UNCLOS. *See* Hillary Rodham Clinton, U.S. Sec'y of State, Remarks at the Joint Session of the Antarctic Treaty Consultative Meeting and the Arctic Council (Apr. 6, 2009), *transcript available at* http://www.state.gov/secretary/rm/2009a/04/121314.htm ("The changes underway in the Arctic will have long-term impacts on our economic future, our energy future, and indeed, again, the future of our planet. So it is crucial that we work together. Here in Washington, the State Department coordinates Arctic policy for the United States, and I am committed to maintaining a high level of engagement with our partners on this. That starts with the Law of the Sea Convention, which President Obama and I are committed to ratifying, to give the United States and our partners the clarity we need to work together smoothly and effectively in the Arctic region.").

124. UNCLOS, *supra* note 18, art. 3.

125. *Id.* art. 57.

126. *Id.* art. 76.

127. *Id.* art. 86.

128. *Id.* art. 62.

69 and 70 of UNCLOS give land-locked and geographically disadvantaged states the right to participate "in the exploitation of an appropriate part of the surplus of the living resources" of the EEZs of coastal states in the same region on an equitable basis, as established through agreements with the coastal states.[129] Thus, UNCLOS provides a clear framework for ownership of MGRs located within the aforementioned regions of the seas.[130] However, because the new wave of MGR bioprospecting is occurring in Antarctica and regions of the Arctic, these traditional demarcations do not provide any guidance.[131]

A recent addition to UNCLOS is Part XI, which attempts to fill in some of the gaps left by the original regional demarcations.[132] Part XI describes "the Area" which encompasses the deep seabed and subsoil beyond any national jurisdiction.[133] Part XI also established the International Seabed Authority to coordinate and control activities of member states in the Area.[134] Most importantly, Part XI decrees that the resources of the Area are the common heritage of mankind:

> 1. No State shall claim or exercise sovereignty or sovereign rights over any part of the Area or its resources, nor shall any State or natural or juridical person appropriate any part thereof. No such claim or exercise of sovereignty or sovereign rights nor such appropriation shall be recognized.
> 2. All rights in the resources of the Area are vested in mankind as a whole, on whose behalf the Authority shall act. These resources are not subject to alienation. The minerals recovered from the Area, however, may only be alienated in accordance with this Part and the rules, regulations and procedures of the Authority.
> 3. No State or natural or juridical person shall claim, acquire or exercise rights with respect to the minerals recovered from the Area except in accordance with this Part. Otherwise, no such claim, acquisition or exercise of such rights shall be recognized.[135]

Part XI also requires the "equitable sharing of financial and other economic benefits derived from activities in the Area through any appropriate mechanism, on a non-discriminatory basis."[136] Although the location of contentious MGRs falls within the Area, Part XI's rules only apply to "solid, liquid or gaseous mineral resources" in the Area, not living organisms.[137]

Another recent addition to UNCLOS is Part XIII which deals with

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129. *Id.* art. 69.

130. But see Leary, *Bi-Polar Disorder?*, *supra* note 15, at 52-54, for a discussion of how some Nordic countries are contesting the extent of Norway's EEZ and its sovereignty over the MGRs within that region.

131. *See* Herber, *supra* note 101, at 139, 142.

132. *See* Agreement Relating to the Implementation of Part XI of the United Nations Convention on the Law of the Sea of 10 December 1982, G.A. Res. 48/263, U.N. Doc. A/RES/48/263 (Aug. 17, 1994).

133. *See* UNCLOS, *supra* note 18, pmbl.

134. *Id.* art. 156.

135. *Id.* art. 137.

136. *Id.* art. 140(2).

137. *Id.* art. 133(a).

marine scientific research.[138] Part XIII permits marine scientific research in the Area but does not provide any guidelines for proprietary rights stemming from discoveries therefrom.[139] As a general principle, Part XIII encourages member states to publish any information that their scientists discover through marine scientific research in order to "actively promote the flow of scientific data and information and the transfer of knowledge resulting from marine scientific research, especially to developing States."[140]

In its present form, UNCLOS does not provide any guidance on MGR access and benefit sharing.[141] The primary difficulty is that MGRs are neither mineral resources nor a measure of biodiversity and thus do not fit into any of the categories covered by the treaty.[142] Furthermore, many of the UNCLOS signatories, as well as the United States, are divided over how to frame the MGR access and benefit-sharing question.[143] The next part of this Note will examine the various views on this subject.

III. The Politics of Genetic Resource Control

A. General Principles

To understand the current status of the debates over MGR access and benefit sharing, it is useful first to place the debate in its larger political and ideological context. Political discussions of genetic resource control generally reflect four basic principles: 1) proprietarian intellectual property rights, 2) community intellectual property rights, 3) national sovereignty, and 4) the common heritage of mankind.[144] The dominant principle in political discussions typically is proprietarian intellectual property rights, a category that consists of both economistic and entitlement concerns.[145] The former subcategory acts to promote society-wide economic efficiency, whereas the latter aims to achieve morally correct proprietarian arrangements of intellectual property rights.[146] The proprietarian intellectual property rights principle closely relates to the Western legal discourse and its individualistic frame of reference.[147] Consequently, developed nations, such as the United States, favor this approach to genetic resource control measures.[148]

The second and third principles associated with political discussions of genetic resource control do not play significant roles in the current debates on MGRs. The principle of community intellectual property rights

138. *See generally id.* Part XIII.
139. *See id.* art. 256; *see also id.* art. 144.
140. *Id.* art. 244.
141. *See generally id.*; Downes et al., *supra* note 23, at 288.
142. *See* Downes et al., *supra* note 23, at 288.
143. Gómez-Robledo & Hill, *supra* note 27, ¶¶ 36-38.
144. *See* STENSON & GRAY, *supra* note 12, at 2.
145. *Id.*
146. *Id.*
147. *Id.* at 3.
148. *See infra* Part III.B.

focuses on the intellectual property rights of indigenous peoples over the genetic resources in their traditional habitats.[149] Because this Note focuses on MGRs from the Arctic and Antarctic, which are located extraterritorially, this principle is not relevant to the current discussion. The third principle, national sovereignty, reflects the rights of nation-states to control the genetic resources within their territory.[150] This Note does not address the national sovereignty principle because the current international legal regime—particularly UNCLOS—adequately addresses the issue of territorial MGRs.[151]

The final principle inherent in political discussions of genetic resource control is the common heritage of mankind. This principle reflects the idea that "humanity as a whole has a right to a share of the natural resources of the world."[152] Third-world nations, as well as developed nations without strong biotechnological industries, typically assert this principle in order to share in the many benefits stemming from genetic resource research and development.[153] The next two sections will demonstrate how the competing principles of proprietarian intellectual property rights and the common heritage of mankind have led to entrenchment of the two sides of the MGR access and benefit-sharing argument.

B. Developed Nations: Argument for the Rule of Capture

On one side of the MGR access and benefit-sharing argument are developed nations, many of which have strong biotechnology industries or the infrastructure to develop one.[154] These nations generally favor the traditional property law "rule of capture" for MGRs that grants ownership to the first nation that appropriates a resource.[155] Additionally, many developed nations argue that Part XI of UNCLOS, the section regulating activities in the Area, permits bioprospecting as a part of the high seas freedom of scientific research.[156] In the alternative, these nations claim

149. *See* STENSON & GRAY, *supra* note 12, at 3.

150. *See id.* at 4.

151. *See supra* Part II.D.

152. *See* STENSON & GRAY, *supra* note 12, at 4.

153. *See id.*; Peter Prows, *Tough Love: The Dramatic Birth and Looming Demise of UNCLOS Property Law (And What is to Be Done About It)*, 42 TEX. INT'L L.J. 241, 291 (2007).

154. *See* Zewers, *supra* note 13, at 172.

155. *See id.; see also* McLaughlin, *supra* note 1, at 258.

156. *See Report of the Ad Hoc Open-Ended Informal Working Group to Study Issues Relating to the Conservation and Sustainable Use of Marine Biological Diversity Beyond Areas of National Jurisdiction*, ¶¶ 27, 72, U.N. Doc. A/61/65 (Mar. 20, 2006) (*prepared by* Juan Manuel Gómez-Robledo & Philip D. Burgess) [hereinafter *Report of the Ad Hoc Working Group*] ("Some delegations cautioned against trying to impose restrictions on the freedom of marine scientific research. They recalled the principle of the Convention dealing with the freedom of marine scientific research on the high seas and noted that undue regulatory mechanisms would only inhibit the work of the scientific community and impose difficulties on it."); Prows, *supra* note 153, at 291. *But see Report of the Ad Hoc Working Group*, *supra*, ¶ 28 ("A number of other delegations emphasized that marine scientific research should be conducted in conformity with the provisions contained in part XIII of [UNCLOS], in particular article 240 on general principles for the

that UNCLOS does not apply to bioprospecting at all.[157] These arguments support the concept of the rule of capture for MGRs.[158]

Using the rule of capture as the guiding principle in MGR appropriation presents several problems. In addition to some nations objecting to patenting living organisms and the building blocks of life on moral grounds,[159] a common complaint that arises is that the rule of capture encourages an "anticommons" situation.[160] Contrary to Professor Garrett Hardin's famous "Tragedy of the Commons" scenario, in which community access to a finite resource leads to selfish use and overexploitation,[161] the anticommons represents a situation in which many individuals rush to enclose and protect resources from community use, leading to under-consumption or suboptimal use of that resource.[162]

The proliferation of gene sequence patents is a prime example of this scenario.[163] In the United States, the first person to isolate a gene sequence and successfully file a patent application can potentially prevent the use of that sequence by "downstream" researchers, such as pharmaceutical companies or other major industries.[164] Downstream actors have the option of trying to contract with the patent holder for the right to use the sequence, but this option is not always successful and can lead to additional, and sometimes prohibitive, transactional costs.[165] Consequently, critics allege that this method of patenting could lead to a dangerous underdevelopment of medical treatments and useful industrial processes.[166]

On an international scale, the tragedy of the anticommons potentially could arise if one country discovers and appropriates a particular genetic sequence from a marine organism with tremendous potential for industrial processes or medical treatment.[167] Under the traditional rule of capture, the discovering nation could stand to benefit greatly from this situation to the detriment of other nations.[168] The looming danger of the anticommons supports the idea of limiting appropriation of MGRs and making

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conduct of marine scientific research and article 241, which provided that marine scientific research activities shall not constitute the legal basis of any claim to any part of the environment and its resources.").

157. *See Report of the Ad Hoc Working Group*, *supra* note 156, ¶¶ 27-30, 72.

158. *See* Prows, *supra* note 153, at 291.

159. *See* Correa, *supra* note 90, at 548-49; *see also Communication from Kenya on Behalf of the African Group, Preparations for the 1999 Ministerial Conference: The TRIPS Agreement*, WT/GC/W/302 (Aug. 6, 1999).

160. *See generally* Safrin, *supra* note 92, at 652-58.

161. Garrett Hardin, *The Tragedy of the Commons*, 162 SCIENCE 1243, 1244-45 (1968).

162. *See* Michael A. Heller, *The Tragedy of the Anticommons: Property in the Transition from Marx to Markets*, 111 HARV. L. REV. 621, 622 (1998); Safrin, *supra* note 92, at 652.

163. Safrin, *supra* note 92, at 653.

164. *See id.*

165. *See id.*

166. *See id.*; *see also* Correa, *supra* note 90, at 545-46.

167. *See* Safrin, *supra* note 92, at 652, 653, 657.

168. *See Marine Genetic Resources*, *supra* note 48, § 5.1; *see also* McLaughlin, *supra* note 1, at 319-20, 322.

them accessible to the entire world as the common heritage of mankind,[169] especially because it appears there may already be an anticommons problem at the national level with regard to MGRs and terrestrial genetic resources within the boundaries of national sovereignty.[170]

C. Developing Nations: Argument for the Common Heritage of Mankind

In 1967, Arvid Pardo, the Maltese Foreign Minister, delivered a speech at the UN General Assembly emphasizing that the deep seabed should not be appropriated by individual nations.[171] Instead, he argued that it was the "common heritage of mankind" and that the world should share its resources equitably through communal international management.[172] Many developing nations subscribe to Pardo's position in the current debates over MGR access and benefit sharing.[173] These nations, including the Group of 77 (G77) and China, argue that UNCLOS's principles of equitable sharing apply to MGRs and, consequently, any products derived from MGRs should be the common heritage of mankind.[174]

One way of achieving this approach to MGR access and benefit sharing is through the creation of databases containing the resulting genetic information and governing legal regulations.[175] The United Nations University Institute for Advanced Studies is in the process of creating such a database that will include up-to-date information on bioprospecting projects in Antarctica, scientific research findings and commercial uses of MGRs, and relevant legal rules.[176] Though the database appears promising, its success will depend on the cooperation of the developed nations that hold the information at present.[177]

IV. Evaluating Possible Legal and Regulatory Gap-Filling Measures

In its final part, this Note will assess potential regulatory gap-filling measures that could result from these debates regarding the MGR access and benefit-sharing dilemma and will analyze how these measures could affect the polar regions. Despite the complex legal status of MGRs, United

169. *See* Safrin, *supra* note 92, at 652-58.
170. *See id.* at 653-58.
171. *See* VOGLER, *supra* note 103, at 7.
172. *See id.*
173. *See* Gillian Joseph, Statement on Behalf of the Group of 77 and China at the General Assembly Ad Hoc Open-Ended Informal Working Group to Study Issues Relating to the Conservation and Sustainable Use of Marine Biological Diversity Beyond Areas of National Jurisdiction (Apr. 28, 2008) [hereinafter Joseph Speech], *available at* http://www.g77.org/statement/getstatement.php?id=080428a. The Group of 77 was established in 1964 and provides developing nations with a unified platform for negotiations within the General Assembly. *See generally* THE GROUP OF 77 AT THE UNITED NATIONS (Mourad Ahmia ed., 3d ed. 2006).
174. *See* Joseph Speech, *supra* note 173.
175. *See Marine Genetic Resources*, *supra* note 48, § 7.2, app. 1.
176. *Id.*
177. *See id.* § 7.2.

Nations delegates and international scholars have proposed a number of possible solutions to the current debates among developed and developing nations. In addition to regular meetings of the Informal Consultative Process on Oceans and the Law of the Sea,[178] the United Nations has developed an Ad Hoc Open-Ended Informal Working Group to study issues relating to the conservation and sustainable use of marine biological diversity beyond areas of national jurisdiction, including ways to facilitate access to and benefit sharing of MGRs.[179] At the Working Group's 2008 meeting, participating member states discussed various gap-filling measures to address this ongoing issue.[180] Though they primarily focused on reforming UNCLOS, other options arose as well.[181] Because the delegates of the Working Group are examining the issue of MGRs beyond national jurisdiction without special regard to any given region,[182] the proposed gap-filling measures could have varying effects on the Arctic and Antarctic regions.[183] The following sections will evaluate the potential impact and viability of some of these proposed measures, which fall into four general categories: 1) reforms to the existing legal and regulatory framework, 2) short-term actions, 3) regional institutional approaches, and 4) the creation of a new legal instrument.[184]

A. Reforming the Existing Regulatory Framework

The primary gap-filling measure that delegates discussed at the 2008 Working Group meeting was reforming the existing regulatory framework to incorporate provisions for extraterritorial MGR access and benefit sharing.[185] Although there are a number of relevant regulatory and legal instruments that, with appropriate amendments, could provide answers to

178. *See Report on the Work of the United Nations Open-Ended Informal Consultative Process on Oceans and the Law of the Sea*, ¶¶ 15-108, U.N. Doc. A/62/169 (July 30, 2007) (*prepared by* Lorraine Ridgeway & Cristián Macquieira) (summarizing the Process's 2007 discussions on marine genetic resources within and beyond national jurisdiction).

179. The Ad Hoc Open-Ended Informal Working Group was established pursuant to G.A. Res. 59/24, ¶ 73, U.N. Doc. A/RES/59/24 (Feb. 4, 2005).

180. *See* Gómez-Robledo & Hill, *supra* note 27, ¶¶ 36, 38.

181. *See id.* ¶¶ 36, 37, 39.

182. *See* G.A. Res. 59/24, *supra* note 179, ¶ 73 (directing the Working Group to examine MGRs generally); Gómez-Robledo & Hill, *supra* note 27, ¶ 1 (acknowledging the Working Group's role to examine MGRs generally).

183. *See, e.g.*, *infra* note 215 and accompanying text.

184. *See* ARICO & SALPIN, *supra* note 2, at 58-62 (identifying a range of feasible approaches for regulating deep seabed bioprospecting activities); KRISTINA M. GJERDE ET AL., OPTIONS FOR ADDRESSING REGULATORY AND GOVERNANCE GAPS IN THE INTERNATIONAL REGIME FOR THE CONSERVATION AND SUSTAINABLE USE OF MARINE BIODIVERSITY IN AREAS BEYOND NATIONAL JURISDICTION § 1.2 (2008), *available at* http://cmsdata.iucn.org/downloads/iucn_marine_paper_2.pdf (providing a parallel analysis of potential gap-filling measures in response to environmental conservation concerns regarding extraterritorial fisheries); Doris König, *Genetic Resources of the Deep Sea–How Can They Be Preserved?*, *in* INTERNATIONAL LAW TODAY: NEW CHALLENGES AND THE NEED FOR REFORM? 141 (Doris König et al. eds., 2007) (discussing the range of options for protecting biodiversity in areas beyond all jurisdiction.).

185. *See* GJERDE ET AL., *supra* note 184, at 1.

these issues, the most likely candidate is UNCLOS.[186] At the Working Group meeting, UN member states agreed that UNCLOS is the most appropriate framework to govern MGR regulation.[187] The states, however, disagreed about how the Treaty's language should be amended and which section of the Treaty would be most appropriate to regulate MGRs beyond national jurisdiction: the Area (Part XI) or the High Seas (Part VII).[188]

The outcome of the categorization debate could have serious ramifications for developing nations. If MGRs fall under the Area's purview, as the G77 and China argue, the resources would be considered a part of the common heritage of mankind and equitable benefit sharing would be required.[189] One advantage of this approach is that the International Seabed Authority, which Part XI established, could provide a ready-made and operational solution for overseeing equitable access and benefit sharing.[190] Two major obstacles to the efficacy of this approach would be the lengthy negotiation process required to amend Part XI to encompass MGRs instead of just mineral resources and the United States' continued refusal to ratify the treaty in its entirety.[191]

If, however, MGRs are considered part of the High Seas, the freedom that attaches to nearly all activities in that region could remove the obligation of developed nations to share economic and informational benefits from their discoveries.[192] Among the nations that believe that the High Seas is the appropriate category for MGRs, some argue that the definition of marine scientific research should be modified to include MGR bioprospecting, while others argue that bioprospecting is inherently distinct from the broad category of marine scientific research.[193] The former opinion would entail that, under a new definition of marine scientific research, MGRs would become part of the common heritage of mankind, whereas the latter would support the rule of capture approach.[194]

Due to the Treaty's broad coverage of all activities on the seas, reforms to UNCLOS would have similar impacts on MGR access and benefit sharing in both the Arctic and Antarctic regions.[195] The potential economic value of polar region MGRs could play a significant role in the negotiation process by providing a strong incentive for developing nations to demand an equitable share of the benefits from biotechnological developments via

186. *See, e.g.*, Rettig, *supra* note 113, at 264-65 (focusing on CBD and TRIPS); Zewers, *supra* note 13, at 151, 158-59 (examining the possibility of regulating MGR benefit sharing through national and international patent laws).

187. Gómez-Robledo & Hill, *supra* note 27, ¶ 36.

188. *Id.*

189. *See* Joseph Speech, *supra* note 173; *see also supra* notes 132-136 and accompanying text.

190. *See* UNCLOS, *supra* note 18, arts. 1, 137; ARICO & SALPIN, *supra* note 2, at 60.

191. ARICO & SALPIN, *supra* note 2, at 60-61; *see also supra* note 123 (noting that the United States might soon accede to UNCLOS in its entirety).

192. *See* UNCLOS, *supra* note 18, art. 86.

193. ARICO & SALPIN, *supra* note 2, at 37.

194. *Id.*

195. *See* UNCLOS, *supra* note 18, pmbl.

classification of MGRs as the common heritage of mankind.[196] Furthermore, the powerful voting bloc of the G77 and China likely will pose a substantial obstacle to developed nations' attempts to implement any measure that ignores developing nations' wishes.[197]

B. Short-Term Actions

In the absence of a panacea for the MGR access and benefit-sharing regulation problems, various UN delegates and international scholars have proposed a number of short-term, interim measures that could provide a more equitable arrangement for developed and developing nations.[198] For example, the EU suggested the implementation of an International Seabed Authority Endowment Fund to help developing nations participate in and benefit from MGR research and use.[199] Similarly, scholars have supported the idea of requiring international MGR patent applicants to submit royalty payments to an international trust fund as a condition of receiving patent protection.[200]

An additional short-term option to address MGR access and benefit sharing is accreditation requirements for bioprospectors.[201] This measure would require potential bioprospectors to register with an independent organization and, if they meet certain predetermined requirements, receive a "license" to carry out research missions in areas beyond national jurisdiction.[202] By keeping track of which nations have carried out MGR recovery missions and, potentially, the results of any subsequent research, the independent organization could satisfy the goals underlying the adoption of accreditation requirements: ensuring free exchange of scientific information and maintaining both intellectual property rights and the unique sovereignty standings of the polar regions.[203]

Though one scholar has supported the idea of accreditation as a method of ensuring compliance with the principles of the Antarctic Treaty System, this option would be highly impractical and would likely have little impact on MGR research missions.[204] In the absence of a binding instrument, compliance with an accreditation system would remain voluntary. Although a "code of conduct" such as this would be easier to negotiate and modify than a comprehensive instrument, implementation levels would be limited due to the difficulty of monitoring compliance and the absence of punitive measures for noncompliance.[205]

196. ARICO & SALPIN, *supra* note 2, at 37.
197. GJERDE ET AL., *supra* note 184, at 16.
198. *See id.*
199. Gómez-Robledo & Hill, *supra* note 27, ¶ 35.
200. *Marine Genetic Resources*, *supra* note 48, § 5.2.
201. *See* Weber, *supra* note 29, at 349.
202. *See id.* at 351-52.
203. *See id.* at 354.
204. *See id.*
205. *See* GJERDE ET AL., *supra* note 184, at 8.

C. Reforming or Expanding Regional Institutions

An alternative approach to the extraterritorial MGR access and benefit-sharing problems is modifying existing regional agreements or creating new ones. Though delegates at the 2008 Working Group meeting primarily discussed this option in the context of marine biodiversity conservation,[206] a parallel argument can be made for access and benefit sharing of MGRs. Regional regulations and cooperative management of MGRs generally eschew the rule of capture in favor of a more equitable approach to access and benefit sharing.[207] This generally leads to the benefits of enhanced monitoring and compliance mechanisms among participating nations, uniformity of specimen collection protocols, decreased likelihood of disputes over resource exploitation by participating nations, and increased funding for research and recovery missions.[208]

The Mesoamerican Barrier Reef System (MBRS) is one example of how a regional approach to genetic resource management can create equitable access and benefit-sharing rules.[209] The MBRS is an extensive network of coral reefs reaching from Mexico to Honduras that contains a vast array of biodiversity, including numerous species of economic value.[210] In 2001, Belize, Guatemala, Honduras, and Mexico—whose coastlines border the MBRS—formed an agreement to cooperate in the conservation and management of the system and its natural resources by coordinating national policies and sharing scientific knowledge.[211] The World Bank has already provided funding for this project, and many scholars consider the agreement to be a model for future international collaborations regarding genetic resources.[212] Although the project is still in an early phase and does not address either the commercial exploitation of MGRs or extraterritorial resources,[213] the MBRS serves as a prime example of how regional agreements represent an efficient and effective means of regulating the access to and the use of natural resources.[214]

Though regional regulation would not be appropriate for MGRs in all areas of the world's oceans,[215] it could be useful for the Arctic polar region.

206. *See Marine Biodiversity Working Group Highlights: Wednesday, 30 April 2008*, EARTH NEGOTIATIONS BULL. (Int'l Inst. for Sustainable Dev., Winnipeg, Canada) May 1, 2008, at 1 [hereinafter *Marine Biodiversity Highlights*], *available at* http://www.iisd.ca/download/pdf/enb2547e.pdf; *see also* Gómez-Robledo & Hill, *supra* note 27, at 26-31.

207. *See* McLaughlin, *supra* note 1, at 322-26.

208. *See id.*

209. *See* Rettig, *supra* note 113, at 262-63.

210. *See id.* at 263-64.

211. *See* McLaughlin, *supra* note 1, at 325.

212. *See id.* at 326.

213. *See* Rettig, *supra* note 113, at 264.

214. *See* McLaughlin, *supra* note 1, at 326-28.

215. Although the Antarctic Treaty System technically is an example of regional regulation, its complex sovereignty status makes it an unlikely candidate for reform to include MGR regulation. *See* ARICO & SALPIN, *supra* note 2, at 59; Herber, *supra* note 101, at 144; *see also supra* Part II.A. For a comprehensive survey of regional access and benefit sharing programs throughout the world, see KATHRYN GARFORTH ET AL., OVERVIEW OF THE NATIONAL AND REGIONAL IMPLEMENTATION OF ACCESS TO GENETIC RESOURCES AND

In addition to the Nordic Council, another intergovernmental forum exists to address sustainable development in the Arctic: the Arctic Council.[216] Members of the Arctic Council include Canada, Denmark, Finland, Iceland, Norway, the Russian Federation, Sweden, and the United States.[217] Although the Arctic Council has not yet discussed the issue of Arctic genetic resource access and benefit sharing,[218] the Council could provide an ideal forum for drafting a regional agreement. As previously discussed, a truly effective gap-filling measure will require the cooperation of the world's major biotechnology players. The participation of United States in the Arctic Council and its continued commitment to playing an active role in the international regulation of the Arctic region suggest that an effective regional agreement could be feasible.[219]

Despite the promising prospects of crafting a regional agreement for MGR access and benefit sharing in the Arctic region, a number of drawbacks exist. One such drawback is the potential for creating a patchwork of inconsistent regulations throughout the world.[220] Moreover, the interests of the Arctic nations might not reflect the interests of the broader international community.[221] Additionally, negotiating a regional initiative could be time-consuming and expensive, particularly if the participating nations must create new institutions.[222] Another limitation of a regional approach to extraterritorial MGR regulation is that, by definition, the controversial resources are located beyond national jurisdictions; thus, unlike the resources in the MBRS, the Arctic Council would not have the authority to grant or restrict access to or regulate benefit sharing of the resources.[223] Though member states might overlook this technicality in upholding the agreement, non-member states could take advantage of this limitation.

D. Creating a New Instrument

At the 2008 Working Group meeting, the EU proposed using the International Treaty on Plant Genetic Resources for Food and Agriculture[224] (ITPGRFA) as a model to create a new legally binding instrument to address extraterritorial MGR access and benefit sharing.[225] ITPGRFA,

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BENEFIT-SHARING MEASURES (3d ed. 2005), *available at* http://www.cisdl.org/pdf/ABS_ImpStudy_sm.pdf.

216. Declaration on the Establishment of the Arctic Council, Sept. 19, 1996, 35 I.L.M. 1382; *see also* Leary, *Bi-Polar Disorder?*, *supra* note 15, at 49.

217. *See* Declaration on the Establishment of the Arctic Council, *supra* note 216.

218. *See* Leary, *Bi-Polar Disorder?*, *supra* note 15, at 49.

219. *See* Presidential Directive, *supra* note 123.

220. *See* GJERDE ET AL., *supra* note 184, at 8.

221. *See id.* at 14.

222. *See id.* at 8.

223. *See* Rayfuse, *supra* note 17, at 7 (noting that the Arctic Council currently lacks authority to create binding regulation); Rettig, *supra* note 113, at 262-63.

224. International Treaty on Plant Genetic Resources for Food and Agriculture, Nov. 3, 2001, *available at* ftp://ftp.fao.org/ag/cgrfa/it/ITPGRe.pdf.

225. *See* Aleksander Čičerov, Minister Plenipotentiary, Permanent Mission of Slovn. to the United Nations, Statement to the Ad-Hoc Open-Ended Informal Working Group to Study Issues Relating to the Conservation and Sustainable Use of Marine Biological Diversity Beyond Areas of National Jurisdiction (Apr. 30, 2008) [hereinafter Čičerov

which entered into effect on June 29, 2004, requires its 116 signatory nations to survey, catalog, and conserve plant genetic resources within their jurisdictions; promote the sustainable use of those resources; and provide technical assistance to developing member nations to fulfill their duties under the treaty.[226] The EU emphasized the desirability of creating an instrument that would utilize a "multilateral system of access and benefit-sharing" as ITPGRFA does by requiring members to freely share germplasm from specific plants with other nations and to pay an equitable share of any economic benefits derived from commercialization of plant products obtained through the system.[227] The EU also noted that using ITPGRFA as a model for a new instrument could quell the debate between the rule of capture and the common heritage of mankind in part;[228] although the raw genetic information from MGRs would become part of the public domain, nations that do not wish to share the technological developments derived from MGR research could alternatively elect to pay a percentage of their commercial benefits to an international fund.[229]

Although the EU's proposal appears promising, its implementation would be difficult. As a preliminary matter, a major difference between the genetic materials targeted by ITPGRFA and the proposed treaty is that the former are located within member states' jurisdictions whereas the latter involves MGRs located beyond all national jurisdictions.[230] Consequently, unlike with plant genetic resources that might be unique to the habitats of another ITPGRFA member state, developed nations with the necessary infrastructure to carry out deep-sea missions to locate and acquire MGRs do not have a similar incentive to sign on to such a treaty.[231]

Moreover, as with the creation of any new international, legally binding instrument, the negotiation process could take a significant amount of time.[232] The inherent difficulty of drafting a universally agreeable instrument that is broad enough to achieve its intended goals but narrow enough so as not to interfere with the existing legal and regulatory framework will likely create significant delays in the implementation of a new treaty.[233] This appears to be the case with the EU's proposed treaty. At the Working Group meeting, attending delegates were sharply divided on whether using ITPGRFA as a model would adequately address MGR access and benefit sharing.[234] Additionally, because the new instrument cannot conflict with

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Speech], *available at* http://www.eu2008.si/en/News_and_Documents/Statements_in_International_Organisations/April/0430UN_Agenda_item_5_e_.html.

226. *See* International Treaty on Plant Genetic Resources for Food and Agriculture, *supra* note 224, arts. 5.1, 13.

227. *See id.* arts. 10-13; *see* Čičerov Speech, *supra* note 225.

228. *See* Čičerov Speech, *supra* note 225.

229. *See id.*

230. *Id.*

231. *See* John Charles Kunich, *Losing Nemo: The Mass Extinction Now Threatening the World's Ocean Hotspots*, 30 COLUM. J. ENVTL. L. 1, 102-03 (2005) (discussing state incentives in environmental treaty law).

232. *See* GJERDE ET AL., *supra* note 184, at 16.

233. *See id.* at 9.

234. *Marine Biodiversity Highlights*, *supra* note 206, at 1.

the relevant provisions of other treaties, such as UNCLOS, the negotiation process would likely require additional lengthy debates, such as the status of MGRs.[235]

Additionally, using ITPGRFA as a model is problematic because the United States and Japan have refused to sign the Treaty due to its lack of clarity regarding intellectual property rights.[236] As with the proposed amendments to UNCLOS, the impact of a new treaty similar to ITPGRFA would be limited if the nations with the most significant biotechnology powers do not agree to the treaty's terms. In order for a new treaty to successfully regulate MGR access and benefit sharing in the polar regions and the rest of the world, it must adequately address the intellectual property rights of member states and of private, commercial entities within those nations.[237] Consequently, until further developments are made in negotiating such an instrument, it remains unclear what type of impact it could have on the polar regions.

E. The Future of MGR Access and Benefit Sharing Negotiations

In the absence of implementing any of the gap-filling measures proposed earlier, the deadlock among UN member states could prolong the current practice of following the rule of capture and allowing developed nations to continue to dominate MGR acquisition and research.[238] At the 2008 Working Group meeting, the delegate from the United States argued against the modification of any existing treaties and the implementation of new treaties by claiming that developing nations already benefit from the discoveries of developed nations.[239] Though maintaining the status quo is essentially similar to including MGR collection in the list of freedoms on the high seas under UNCLOS, this result would not be the most equitable outcome because it overlooks the interests of a large percentage of the world's nations.

The most promising solution to the issues of polar MGR access and benefit sharing, but perhaps the most difficult to achieve, would be for UN delegates to resolve the status of all extraterritorial MGRs under UNCLOS. Despite the unique legal and regulatory frameworks of the Arctic and Antarctic regions, the most equitable and efficient result would be for the MGRs in those regions to be treated in the same way as others. Regardless of whether the delegates opt for a common heritage of mankind or rule of capture approach, this solution would ensure that the polar regions are kept in uniformity with the rest of the world's oceans and prevent the creation of a patchwork of inconsistent regulations. Moreover, if the United

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235. *See* GJERDE ET AL., *supra* note 184, at 9; *supra* Part II.B.

236. Shawn N. Sullivan, *Plant Genetic Resources and the Law: Past, Present, and Future*, 135 PLANT PHYSIOLOGY 10, 13 (2004).

237. See *id.* at 14 for further discussion of ITPGRFA's unclear stance on intellectual property rights.

238. *See* Zewers, *supra* note 13, at 175.

239. *See Marine Biodiversity Highlights*, *supra* note 206.

States were to accede to UNCLOS in its entirety, this approach would provide a very strong solution to the problem.

If the UNCLOS member states are unable to reach a consensus on how to amend the treaty, the next best alternative for polar MGR regulation would be to implement a combination of the other gap-filling measures mentioned in this Note—also known as the "toolbox" approach.[240] Due to the inherent difficulties of negotiating a new instrument aimed directly at extraterritorial MGRs, either generally or in the Arctic or Antarctic regions, interested parties in the polar regions and throughout the world should instead focus on short- and medium-term solutions, such as implementing or expanding regional MGR rights management programs. Although the Antarctic Treaty System already represents an effective example of regional regulation, the Treaty's member states are unlikely to expand its coverage to include MGR regulation.[241] However, a regional MGR rights management program could provide a feasible method for regulating MGR access and benefit sharing in the Arctic. Even though this approach would not provide the widespread, binding control that could result from either amending UNCLOS or creating a new instrument, this solution could provide more immediate results and participating nations could modify such agreements once the MGR industry develops further. Finally, short-term solutions, such as implementing licensing and accreditation requirements for bioprospecting in the polar regions, though extremely limited in efficacy, could serve as an additional measure to fill part of the gaps in the regulation of extraterritorial polar MGRs.

Conclusion

In the coming years, technological advances are likely to increase commercial demand and interest in MGRs and their byproducts.[242] A result of the increased demand and profits from these advances may be further debates about the proper form of benefit sharing from extraterritorial MGRs and further politicization of the issues. This will be particularly true for MGRs in the Arctic and Antarctic regions due to their unique genetic characteristics and broad commercial utility.

Although the complex legal and regulatory status of the polar regions poses a substantial hurdle to implementing comprehensive gap-filling measures for MGR regulation, the United Nations and relevant regional political bodies for the Arctic and Antarctic should take additional steps now to rectify the inadequacy of the current regulatory framework rather than waiting for the problem to worsen. The United Nations' proactive approach to the problem through in-depth discussions in the General Assembly, Informal Consultative Process, and Working Group represents a positive

240. Gómez-Robledo & Hill, *supra* note 27, ¶ 44 (noting that some delegates favored the use of short- and medium-term measures while a long-term solution is negotiated).

241. *See* Herber, *supra* note 101, at 144.

242. *See* David Leary et al., *Marine Genetic Resources: A Review of Scientific and Commercial Interest*, 33 MARINE POL'Y 183, 189-91 (2009) (discussing the commercial and potential market value of MGRs).

step towards reaching an equitable and feasible solution to the problem as a whole. The UN should continue in its current path and strongly encourage member states to overcome their fundamentally contrasting viewpoints to reach a mutually acceptable agreement. If member nations cannot reach a consensus on the proper classification of MGRs under UNCLOS, smaller measures—in the form of regional rights management programs or short-term actions—would be better than no action at all.

Finally, it is important to note that the issue of extraterritorial MGR access and benefit sharing in the polar regions does not exist in an analytical vacuum. Though access and benefit sharing are property law concerns and thus distinct from other legal fields, a truly effective solution must be compatible with the wider context of treaties and laws regarding topics such as environmental regulation and intellectual property rights. The path forward for MGR access and benefit-sharing regulation in the Arctic and Antarctic regions undoubtedly will be difficult. However, with cooperation and determination, a feasible, acceptable solution should be possible.